

Claims listing:

1. (original) A photonic device, comprising:  
a silicon semiconductor based superlattice that includes a plurality of layers that form a plurality of repeating units, wherein at least one of the layers in the repeating unit is an optically active layer with at least one species of rare earth ion present with a density of at least  $10^{18}$  ions per cubic cm
2. (original) The device of claim 1, wherein each layer in the plurality of layers is a pure crystalline structure.
3. (original) The device of claim 1, wherein the rare earth ion is present with a density of at least  $10^{20}$  ions per cubic cm.
4. 9. (cancelled).
10. (original) The device of claim 1, wherein the repeating units have uniform layer constructions.
11. (cancelled).
12. (original) The device of claim 1, wherein a crystal field of the device is configured to be spatially variable by altering composition of layers.
13. (original) The device of claim 1, wherein a composition of the repeating units varies as a function of distance along a superlattice growth.
14. (original) The device of claim 1, wherein the repeating units includes ultra-thin layers.
15. (original) The device of claim 14 wherein the ultra-thin layers have a thickness of 1000 Å or less.
16. (original) The device of claim 14 wherein the ultra- layers are thin enough to be non-bulk material layers.
17. (original) The device of claim 1, wherein each repeating unit has two or

more layers.

18. (original) The device of claim 1, wherein each repeating unit is repeated N times, where N is a whole or partial integer of monolayers.

19. (original) The device of claim 1 wherein each repeating unit has at least two layers made with different compositions.

20. (original) The device of claim 1, wherein each repeating unit has at least two layers with different thicknesses.

21. (original) The device of claim 1 wherein each repeating unit has three layers made of with different compositions.

22. – 27. (cancelled).

28. (original) The device of claim 1, wherein the rare earth ion is Er.

29. (cancelled).

30. (original) The device of claim 1, wherein the multi-layer silicon based superlattice is grown on a silicon substrate.

31. 35. (cancelled).

36. (original) The device of claim 1, wherein the multi-layer silicon based superlattice is grown on a silicon-on-insulator wafer.

37. (original) The device of claim 1, wherein the active region layer has a lattice constant that is less than a lattice constant of an underlying bulk silicon substrate.

38. – 45. (cancelled).

46. (original) The device of claim 12, wherein the crystal field is modified by a strain field induced by lattice mismatched layers in a repeating unit.

47. – 90. (cancelled).